CLAIMS

1. A method for controlling the rotation speed of a motor

- with which a digital rotation speed controller is associated
- and which, during operation, furnishes an actual-value signal for the rotation speed in the form of a rotation speed frequency signal

to a rotation speed setpoint defined in the form of a setpoint frequency signal,

comprising the following steps:

in a first time segment, a first numerical frequency value that characterizes the rotation speed of the motor is ascertained from the rotation speed frequency signal;

in a second time segment that is substantially simultaneous with the first time segment, a second numerical frequency value that characterizes the frequency of the setpoint frequency signal is ascertained from the setpoint frequency signal;

by means of the first and second numerical frequency values, the rotation speed of the motor is regulated in the digital rotation speed controller to a rotation speed that is associated with the setpoint frequency signal according to a defined mathematical relationship.

2. The method according to claim 1, wherein for ascertaining the numerical frequency values, a time measurement between defined events of the relevant frequency signal is performed.

3. The method according to claim 2, wherein edges of the relevant frequency signal serve as events between which a time measurement takes place.

4. The method according to claim 2 or 3, wherein the same time standard is used for the time measurement for ascertaining the first numerical frequency value and for the time measurement for ascertaining the second numerical frequency value.

5. The method according to one of the foregoing claims, for determining the frequency of a frequency signal which, at a constant frequency per unit time, comprises a fixed number of events in the manner of pulses, edges, or the like,

comprising the following steps:

a) at a first predetermined instant, measurement of a frequency datum is initiated;

b) a second instant, at which an event of the frequency signal subsequent to the first predetermined instant occurs, is ascertained;

c) the number of events of the frequency signal subsequent to the second instant is sensed;

d) at a third predetermined instant, termination of measurement of the frequency datum is initiated;

e) a fourth instant, at which an event of the frequency signal subsequent to the third predetermined instant occurs, is ascertained;

f) the frequency datum is calculated from the time offset between the second instant and fourth instant, and from the number of events of the frequency signal between said instants.

6. The method according to claim 5, wherein for ascertaining the fourth instant, the next event of the frequency signal is selected as the event subsequent to the third predetermined instant.

7. The method according to claim 5, wherein for ascertaining the fourth instant, what is selected as the event subsequent to the third predetermined instant is that next event of the frequency signal at which the number of events since the second instant is equal to a product a * N, where a and N are whole numbers of which the one is equal to at least 1 and the other is equal to at least 2.

8. The method according to claim 7, wherein in the case of a rotation speed frequency signal (f), the number N corresponds to a fixed number of events per revolution of the rotor.

9. The method according to one or more of the foregoing claims 5 through 8, wherein measurements in accordance with claim 5 are performed continuously.

10. The method according to claim 9, wherein the first predetermined instants of successive measurements have defined time offsets (T_A); and

wherein the third predetermined instants each have a substantially constant time offset from the associated first predetermined instants.

11. The method according to claim 9 or 10, wherein the third predetermined instant of a first measurement corresponds to the first predetermined instant of a second measurement subsequent thereto.

12. The method according to claim 11, wherein the fourth instant of a first measurement corresponds to the second instant of a second measurement subsequent thereto.

13. The method according to one or more of the foregoing claims, wherein for generating a frequency datum, the number (N) of events of the frequency signal between the second and fourth instants is divided by the time offset (Δt) between said two instants.

14. The method according to claim 13, wherein the rotation speed datum is parameterized by multiplication by a constant factor.

15. The method according to claim 14, wherein the constant factor is selected so that the rotation speed datum substantially corresponds to a physical rotation speed, e.g. revolutions per minute or revolutions per second.

16. The method according to one of claims 13 through 15, wherein the division using a numerator proportional to the number of pulses between the second and fourth instants and a denominator proportional to the duration between the second and fourth instants yields as result an integral frequency datum and a remainder; and wherein the resulting remainder is taken into account by addition to the numerator of the subsequent measurement.

Example of an integral division: 7 / 3 = 2, remainder 1. 7 is the numerator, 3 the denominator, and 1 the remainder. The result of this division is 2.

17. A method for obtaining a datum concerning the rotation speed of a rotating object, hereinafter called a rotor, according to one or more of the foregoing claims,

comprising an arrangement for generating a rotation speed signal (f) which comprises, for each rotor revolution, at least one event in the manner of a pulse, a signal edge, or the like, and comprising the following steps:

a) during a first measurement period (T_M1), the number (N) of events of the rotation speed signal (f) is sensed;

b) the time duration (Δt) of the first measurement period (T_M1) is sensed;

c) by means of an integral division ("div") in which the number of events during the first measurement period (T_M1) is in the numerator and the time duration of the first measurement period (T_M1) is in the denominator, a first integral rotation speed datum and a remainder are generated as the result (FIG. 15: S372; FIG. 16: S472);

d) during evaluation of a subsequent measurement, said remainder (REM_n_OLD; REM_n_s_OLD) is taken into account in the integral division then taking place, by addition to the numerator.

18. The method according to claim 17, wherein the number (N) of events prior to the integral division (S372; S472) is multiplied by a constant factor (2^h; 2^h_s) that is greater than 1, in order to obtain a result of the integral division that is large in relation to the remainder (REM_n; REM_n_s).

19. The method according to claim 18, wherein the constant factor is a power of two (2^h; 2^h_s).

20. The method according to claim 19, wherein the exponent (h; h_s) of the power of two is an adjustable variable.

21. An apparatus for carrying out a method according to one of the foregoing claims,

wherein in order to obtain a datum concerning the rotation speed of a rotating object, hereinafter called a rotor (32; 32', 32"), a sensor (61) is provided which furnishes a rotation speed signal (f) that comprises a defined number of events (FIG. 10: 110) for each revolution of the rotor (32; 32'; 32"),

comprising a source (23) for control signals (FIG. 10: 191, 193, 195);

comprising a counter (INT_CNT_f) for events (110) of the rotation speed signal (f);

comprising a program-controlled apparatus (23) for analyzing the aforesaid signals, associated with which is a program that is configured for executing the following steps:

a) measurement of a rotation speed datum is initiated by means of a first control signal (FIG. 10: 191);

b) a first instant (FIG. 10: 197), at which an event (110) of the rotation speed signal (f) subsequent to the first control signal (FIG. 10: 191) occurs, is ascertained;

c) the number of subsequent events (110) of the rotation speed signal (f) is sensed by means of the counter (INT_CNT_f) for events (110) of the rotation speed signal (f);

d) termination of measurement of the rotation speed datum is initiated by means of a second control signal (FIG. 10: 193);

e) a second instant (FIG. 10: 199), at which an event of the rotation speed signal (f) subsequent to the second control signal (FIG. 10: 193) occurs, is ascertained;

f) a rotation speed datum (n) is calculated from the time offset (FIG. 10: Δt_MEAS_f(197-199)) between the first instant (FIG. 10: 197) and second instant (FIG. 10: 199), and from the number (N) of events (110) of the rotation speed signal (f) between said two instants.

22. The apparatus according to claim 21, wherein the generator for the control signals comprises a timer (TIMER0).

23. The apparatus according to claim 22, wherein the timer (TIMER0) is configured so as to trigger interrupt operations (TIMER0 Interrupt) as control signals.

24. The apparatus according to one or more of Claims 21 through 23, wherein a timer (TIMER1) is provided for measurement of the time offset between the first and second instants.

25. The apparatus according to claim 24, wherein the timer (TIMER1) for measurement of the time offset between the first and second instants is configured as a ring counter.

26. The apparatus according to claim 25, wherein the ring counter (TIMER1) counts continuously, and the end of a completed measurement is substantially identical to the beginning of a new measurement.

27. The apparatus according to one or more of claims 21 through 26, wherein a signal of an electronically commutated motor serves as the rotation speed signal.

28. The apparatus according to one or more of claims 21 through 27, wherein the counter (INT_CNT_f) for events (110) of the rotation speed signal (f) is provided in the program-controlled apparatus (23).

29. A motor in which the rotation speed can be regulated to zero by means of a setpoint signal in the form of a frequency (f_s), by the giving a frequency value of zero to said setpoint signal.

30. A method for controlling the rotation speed of a motor which has a rotor and with which a rotation speed controller is associated, in order to control the rotation speed of said rotor,

comprising a rotation speed frequency signal (f) having a frequency proportional to the rotation speed of the rotor;

comprising a setpoint frequency signal (f_s);

the rotation speed of the rotor being controlled in such a way that the frequency of the rotation speed frequency signal (f) and the frequency of the setpoint frequency signal (f_s) are at a defined ratio (y/z) to one another.

31. The method according to claim 30, wherein the ratio between the frequencies (f) and (f_s) is influenced by at least one parameter.

32. The method according to claim 31, wherein the ratio between the frequencies (f) and (f_s) is defined in the controller by means of at least one parameter (X; Y).

33. The method according to claim 32, wherein the at least one parameter is stored in a nonvolatile memory.

34. A method for ascertaining frequency in the context of a plurality of signals (f and f_s), said signals comprising frequency data in the manner of pulses, edges, or the like, comprising the following steps:

a) for at least two of said signals, measurement of their frequency is initiated at a first predetermined instant;

b) for each of said signals, a second instant, at which a frequency datum of said signal subsequent to the first predetermined instant occurs, is ascertained;

c) the number of frequency data of each of said signals subsequent to the second instant is sensed separately;

d) at a third predetermined instant, termination of measurement of the frequency is initiated for said signals;

e) for each of said signals, a fourth instant, at which a frequency datum of said signal subsequent to the third predetermined instant occurs, is ascertained;

f) from the time offset between the second instant and fourth

instant, and from the number of frequency data of the relevant signal between said instants, a magnitude characterizing its frequency is determined for each of the signals measured.

35. The method according to claim 34, wherein for ascertaining the fourth instant, the next frequency datum of the relevant signal is selected as the frequency datum subsequent to the third predetermined instant.

36. The method according to claim 34, wherein for ascertaining the fourth instant, what is selected as the frequency datum subsequent to the third predetermined instant is that next frequency datum of the relevant signal at which the number of frequency data since the second instant corresponds to an integral multiple of a whole number from the series 2, 3, 4, ...

37. The method according to one of claims 34 through 36, wherein measurements are performed continuously and the third predetermined instants each have a substantially constant time offset (T_A) from the associated first predetermined instants.

38. The method according to claim 37, wherein the third predetermined instant of the measurement corresponds to a signal of the first predetermined instant of a subsequent measurement.

39. The method according to claim 37 or 38, wherein the fourth instant of a measurement corresponds to the second instant of a subsequent measurement of the same signal.

40. The method according to one of claims 34 through 39, wherein the first predetermined instants for initiating measurement of the plurality of signals are substantially identical.

41. The method according to claims 34 through 40, wherein the third predetermined instants for initiating termination of the measurement of the plurality of signals are substantially identical.